

56. A control system for controlling the operation of a door operator unit to move a door between open and closed positions, said operator unit including an electric drive motor, a drive unit interconnecting said motor with a door, and an electrically operated brake assembly operably connected to at least one of said drive motor and said drive unit for braking rotation of an output shaft of said drive unit, said brake assembly including an electric actuator for engaging and disengaging a brake member, said control system comprising:

a controller operable to provide door open, door close and door stop signals;

a motor drive circuit adapted to receive control signals from said controller to effect operation of said drive motor to provide for one of opening and closing said door; and

a brake control circuit operably connected to said controller and operable to provide signals to said brake actuator for at least one of releasing said brake member and for actuating said brake member to provide controlled rotation of said output shaft.

57. The control system set forth in Claim 56 wherein:

said brake control circuit is operable for releasing said brake member substantially simultaneously with energizing said drive motor.

58. The control system set forth in Claim 56 including:

a motor drive status feedback circuit operably connected to said motor drive circuit and operable to receive a signal from said motor drive circuit when one or the other of plural motor drive relay actuators and an associated motor interlock relay are energized to provide a feedback signal to said controller.

59. The control system set forth in Claim 58 including:

a motor watchdog circuit operably connected to said motor drive circuit and including a switch connected to said motor drive circuit and to means for receiving a signal from said controller, said means being operable in response to not receiving a signal from said controller to effect shutdown of said drive motor.

60. The control system set forth in Claim 59 wherein:

said motor watchdog circuit is operably connected to said brake control circuit to prevent release of said brake member when said controller is inoperative.

61. The control system set forth in Claim 56 including:

a brake release feedback circuit operably connected between said brake control circuit and said controller for providing a brake status feedback signal to said controller.

62. The control system set forth in Claim 56 including:

door position limit indicators for indicating when said door has reached an open position and a closed position, respectively, and a circuit connected to said door position limit indicators and said controller for providing input signals to said controller to indicate when said door has reached an open limit position and a closed limit position, respectively.

63. The control system set forth in Claim 56 including:

a door reverse control circuit adapted to be connected to a device for providing a signal to effect reversing the direction of movement of said door when said door is moving toward a closed position, said reverse control circuit being operable to provide an input signal to said controller to effect operation of said operator unit to stop movement of said door toward a closed position and effect operation of said operator unit to move said door to an open position.

64. The control system set forth in Claim 56 including:

a keypad operably connected to said controller and to a decoder circuit by way of a keypad driver circuit for providing calibration of a selected function controlled by said controller including at least one of a door limit position overrun time delay, a progressive braking rate for applying braking action by said brake assembly to stop rotation of said output shaft, a mid-stop setting for arresting movement of said door between its open and closed positions, a maximum run time of said operator unit to at least one of open and close said door, and deenergizing said drive motor for a predetermined time commencing with deenergization of said motor.

65. The control system set forth in Claim 64 wherein:
said control system is mounted in an enclosure and is operably connected to said drive motor, said drive unit and said brake assembly by connector means whereby said enclosure may be selectively mounted on said operator unit and remote from said operator unit.

66. The control system set forth in Claim 56 wherein:
one of said controller and said brake control circuit include circuit elements operable to provide a pulse signal to said brake assembly to provide said controlled rotation of said output shaft.

67. A control system for controlling the operation of a door operator unit to move a door between open and closed positions, said operator unit including an electric drive motor, a drive unit interconnecting said drive motor with a door, and an electrically operated brake assembly operably connected to at least one of said drive motor and said drive unit for braking rotation of an output shaft of said drive unit, said control system comprising:

a programmable controller operable to receive door open, door close and door stop signals and to provide control signals to said drive motor;

a brake control circuit operably connected to said controller and operable to control engagement and release of said brake; and

a keypad operably connected to said controller for providing calibration of a selected function controlled by said controller including at least one of a braking rate for applying braking action by said brake assembly to control rotation of said output shaft, a setting for arresting movement of said door between its open and closed positions, a maximum run time of said operator unit to provide at least one of opening and closing said door, and deenergizing said motor for a predetermined time commencing with deenergization of said motor.

68. The control system set forth in Claim 67 including:

a visual display operably connected to said controller for displaying a selected condition code in an operating mode of said control system and calibration information when said control system is in a calibration mode.

69. The control system set forth in Claim 68 including:

a memory operably connected to said controller and operable to store signals related to multiple error codes for recall and display on said visual display.

70. The control system set forth in Claim 67 wherein:

said controller includes a timer for automatically setting a maximum run time of said operator unit between open and closed positions of said door based at least on a measured run time of said door between said open and closed positions.

71. A method for controlling the operation of a door operator unit to move a door between open and closed positions, said operator unit including a drive unit connected to said door, an electrically operated brake assembly operably connected to said drive unit for braking rotation of an output shaft of said drive unit, and a control system including a controller, said method comprising the steps of:

moving said door toward one of an open and closed limit position; and

upon said door moving toward one of said open and closed positions, causing a brake operator of said brake assembly to provide controlled rotation of said output shaft by applying a pulse width modulated electrical signal to said brake operator.

72. The method set forth in Claim 71 including the step of:

reducing a duty cycle of said modulated signal applied to said brake operator in preset steps at selected time intervals to control rotation of said output shaft.

73. The method set forth in Claim 72 including the step of:

providing a calibration circuit operably connected to said controller; and

selecting values of duty cycle and time interval by way of said calibration circuit to effect operation of said brake operator.
